J/ψ suppression in heavy ion collisions – interplay of hard and soft QCD processes*

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We study J/ψ suppression in AB collisions at the SPS assuming that the charmonium states evolve linearly from small, color transparent configurations. Perturbative QCD is applied to the production of charmonium states by simulating nucleus-nucleus collisions in the impulse approximation. The resulting space-time distribution of charmonium production points is inserted into the evolving hadronic environment calculated with the Ultrarelativistic Quantum Molecular Dynamics, UrQMD, model [1].

The charmonium states (χ, J/ψ', J/ψ) are distributed according to their assumed production probability times their decay probability to J/ψ's and according to a parametrized momentum distribution. The dissociation cross sections for $X(c\bar{c}) + N$ are taken from [2]. Charmonium-meson cross sections are reduced by a factor of 2/3 from the corresponding baryon values. The cross sections correspond to the geometrical transverse radii $r_T^i = \sqrt{\frac{\sigma^i}{\pi}}$ of the charmonium states. We use σ^i to estimate the respective formation times τ_F^i of the charmonium states by choosing $\tau_F^i = r_T^i/c$. We also take into account the formation time of comoving mesons, on average, $\tau_F \approx 1$ fm/c. Leading hadrons are allowed to interact with a reduced cross section even within their formation time.

Figure 1 shows the J/ψ production cross section in our model for several projectile-target combinations in comparison to experimental data [3]. Considering only nuclear dissociation results in a smaller J/ψ suppression than seen in the data, in particular for nucleus-nucleus reactions. By taking the nonequilibrium charmonium-meson interactions into account, good agreement with the data is obtained. The observed E_T dependence of the J/ψ to

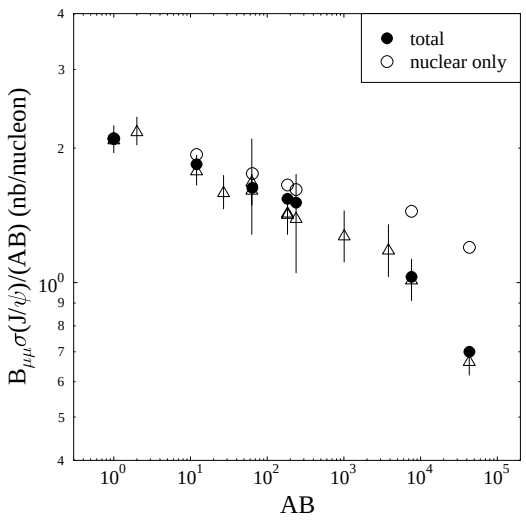

Figure 1: J/ψ-production as a function of AB compared to data [3] (open triangles).

Drell-Yan ratio in Pb+Pb collisions is also reasonably reproduced by the model. The calculated result is smooth, without abrupt discontinuities Thus, within our model, the data on J/ψ cross sections at the SPS are not inconsistent with a hadronic scenario.

[1] S.A. Bass *et al.*, Prog. Part. Nucl. Phys. 41 (1998) 225.
[2] L. Gerland *et al.*, Phys. Rev. Lett. 81 (1998) 762.
[3] M.C. Abreu *et al.* (NA50 Collab.), Phys. Lett. B410 (1997) 327, 337.

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